

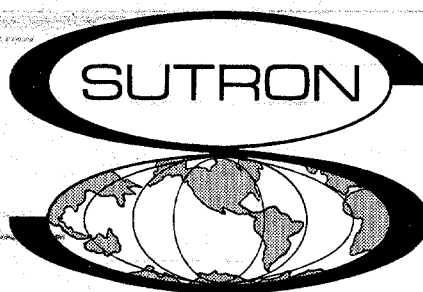
Contract No. DOT-FH-11-9503

Sutron Report No. SCR-342-79-016

APPENDIX B
ANNOTATED BIBLIOGRAPHY
STREAM CHANNEL DEGRADATION AND
AGGRADATION: CAUSES AND CONSEQUENCES
TO HIGHWAYS

7 September 1979

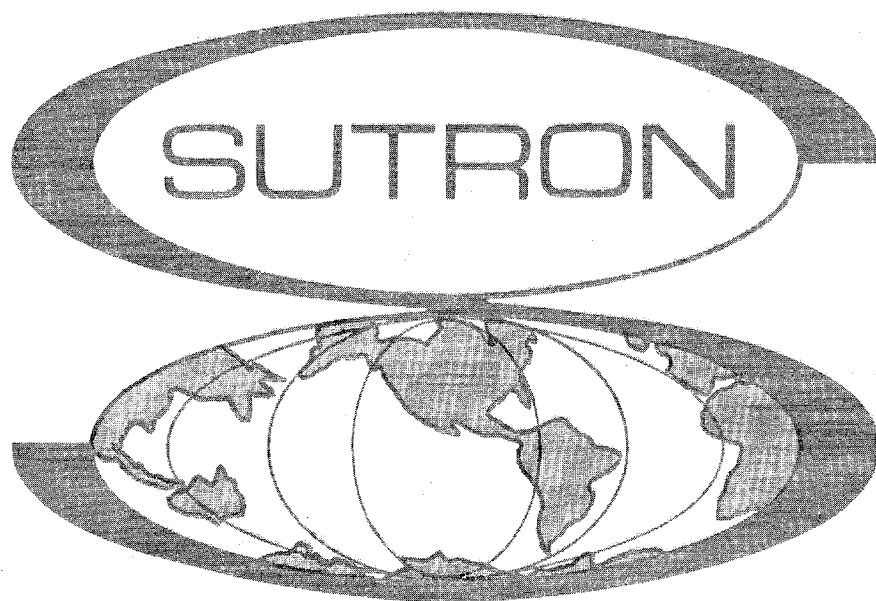
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THE SUTRON CORPORATION

1925 North Lynn Street Arlington, Virginia 22209



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A G G R A D A T I O N & D E G R A D A T I O N

CASE HISTORIES
CATEGORY A&D-1

ABBOTT, P. O.

Bureau of Reclamation, Denver, CO., Flood Hydrology Section.

"Observed Channel Changes in a Mountain Stream Due to Increased Flow from Transbasin Imports."

In anticipation of increased flow in the channel of Lake Fork due to two recently completed transbasin diversions, data were collected on the flow, channel geometry, and bed composition of that channel for the pre-development period. During early stages of the new diversions, the effect of the increased flow in the channel was observed. After a period of years, during which these increased flows will be carried in the Lake Fork channel, data will be collected which should throw additional light on the processes involved in mountain stream channel adjustment.

Proceedings of the Third Federal Inter-Agency Sedimentation Conference, 1976; Denver, CO., March 22-25, 1976. Water Resources Council, Wash., D.C., Sedimentation Committee, p. 5-25 - 5-35, 1976.

Category A&D-1.

BOUCHER, P.R.
Geological Survey, Washington, D.C.

"Sediment Transport by Streams in the Palouse River Basin,
Washington and Idaho, July 1961-June 1965."

The average annual sediment discharge of the Palouse River at
its mouth was about 1,580,000 tons per year, and the estimated
average annual sediment yield was 480 tons per square mile.

The Superintendent of Documents, U.S. Government Printing
Office, Washington, D.C. 20402.

Category A&D-1.

Bureau of Reclamation, Denver, CO.

"Behavior of Middle Loup River Channel as Influenced by
Milburn Diversion Dam."

This report updates aggradation and degradation studies made
at Milburn diversion dam on the Middle Loup River in central
Nebraska. Aggradation above the dam has proceeded at a rate
and to an extent beyond original expectations. Degradation
has reached a depth greater than anticipated and extends at
least 3½ mi downstream from the dam.

PAP, Sedimentation Branch, Div. Proj. Invest. Bur. of Reclam,
Denver, CO., May 1968.

Category A&D-1.

CHANG, F. M.

"A Sample Comparison of the Geomorphic Character of Two River Basins as Related to Susceptibility to Bridge Failure."

From the well-known hypothesis that it is expected that a degree of geologically based similarity would exist on the surface properties of those systems showing a similarity of surface geometry, it is reasonable to assume that drainage basins with the same degree of stability (or instability) possess a certain similarity in geomorphology and channel hydraulics. The study points out the importance of a geomorphic investigation of the basin and to emphasize the need for preventive maintenance of existing bridges.

NTIS, Springfield, VA 22161 as PB-240 167, in paper copy, in microfiche. Dept. of Transportation Report FHWA-RD-74-74, October 1974.

Category A&D-1.

DORT, W. JR. and RATZLAFF, J.R.
Kansas Water Resources Research Institute.

"Recent Variations in Course and Regimen, Kansas River and
Nearby Reaches of Missouri River."

Changes in stream morphology can be deterministic (alterations
of variables within the physical system by climatic or cultural
influences and effects) or probabilistic (random processes).

Available from National Technical Information Service as PB-197
593.

Category A&D-1.

DOYLE, P.F. and CHILDERS, J.M.
Geological Survey, Anchorage, Alaska.

"Channel Erosion Surveys Along Taps Route, Alaska, 1975."

Channel surveys at 27 sites along the Trans-Alaska pipeline
route during 1975 documented significant channel changes and
identified possible causative factors.

Open-File Report (Basic Data), 1975.

Category A&D-1.

KLAGES, M. G., LOGAN, L. D. and HSIEH, Y. P.
Montana State University, Bozeman, Department of Plant and
Soil Science.

"Suspended Solids Carried by the Gallatin River of Southwestern
Montana: Amounts Carried During Spring Runoff."

Erosion resulting from spring snowmelt and resultant runoff is
the major contributor to suspended solids in the Gallatin River.

Northwest Science, Vol. 47, No. 4, p. 203-212, 1974.

Category A&D-1.

LEOPOLD, L. B.
Geological Survey, Berkeley, California.

"River Channel Change with Time: An Example."

Despite the trend toward increasing cross-sectional area, the net result after 20 years was a channel smaller by 20% than it had been originally. Urbanization did not alter the rate of channel migration.

Geological Society of American Bulletin, Vol. 84, No. 6,
p. 1845-1860, June 1973.

Category A&D-1

SAYRE, W. W. and KENNEDY, J. F. (Editors)
Iowa Institute of Hydraulic Research

"Degradation and Aggradation of the Missouri River."

This report contains material presented at a workshop in Omaha, Nebraska, 23-25 January, 1978. Four subgroups reported on the background and history of degradation and aggradation in the Missouri River, historic and current factors contributing to the problem, future rate of aggradation and degradation and possible corrective measures. Further study, data collection and mathematical modeling was recommended to optimize the benefits of river regulation.

Proceedings of a Workshop held in Omaha, Nebraska, 23-25 January, 1978.

Category A&D-1.

SCOTT, K. M.
Geological Survey, Washington, D.C.

"Scour and Fill in Tujunga Wash--A Fanhead Valley in Urban Southern California--1969."

In Tujunga Wash in Southern California, extensive scour and fill occurred during the recordbreaking 1969 floods in this 3-mile-long, partly urbanized Fanhead Valley. Maximums of 20 ft of net scour and 35 ft of net fill were measured.

GPO, Wash., D.C. 20402, Price \$0.70. Geological Survey Professional Paper 732-B, 1973.

Category A&D-1.

TRIMBLE, S.W.

California University, Los Angeles, Dept. of Geography.

Coon Creek Valley is a severely eroded watershed in the driftless area of Wisconsin between 1850 and 1938. A net total of about 19,500 CU DKM (15,000 Acre-ft) of sediment was deposited within the system. A rate of about 45 CU DKM/sq KM (116 acre-ft/sq. mile), or 0.7 CU DKM/sq KM/yr (1.5 acre-ft/sq mile/year) from the watershed exclusive of the main valley flood plains.

Proceedings of the Third Federal Inter-Agency Sedimentation Conference, 1976, Denver, Colorado, March 22-25, 1976. Water Resources Council, Washington, D.C., Sedimentation Committee, p. 5-100 - 5-112, 1976.7, Fig. 4, Tab. 4.

Category A&D-1.

WILLIAMS, G. P. and GUY, H. P.
Geological Survey, Washington, D.C.
"Erosional and Depositional Aspects of Hurricane Camille
in Virginia, 1969."

Erosion and sedimentation resulting from the worst natural disaster in central Virginia's recorded history, the flood resulting from an 8-hour deluge of about 28 inches of rain on the night of August 19-20, 1969, are described. Erosion resulted mainly from debris avalanches down the mountainsides and channel scour along streams and headwater tributaries.

GPO, Washington, D.C. 20402, Price \$1.80 paper copy. Professional Paper 804, 1973.

Category A&D-1.

WINKLEY, BRIAN R.
U. S. Army Engineer District, Vicksburg Corps of Engineers

"Man-Made Cut-offs on the Lower Mississippi River, Conception, Construction, and River Response."

This report analyzes the response of the Mississippi River to man made cut-offs. Both advantages and disadvantages are discussed. Stage vs. discharge and specific gage records show the general lowering of stage for a given discharge. Possible areas of degradation and aggradation can be found.

Potamology Investigations Report 300-2, U.S. Army Corps of Engineers, Vicksburg District.

Category A&D-1.

A G G R A D A T I O N & D E G R A D A T I O N

CONTROL METHODS
CATEGORY A&D-2

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York, Hydraulics Division.

"Sediment Control Methods: B. Stream Channels."

General knowledge of control of erodible stream channels based on experience is summarized.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 98, No. HY7, Paper 9071, p. 1295-1326, July 1972.

Category A&D-2.

BRICE, J. C. and BLODGETT, J. C., U.S.G.S.

"A Study of Countermeasures for Hydraulic Problems at Bridges."

The purpose of this study was "to develop guidelines to assist design, maintenance, and construction engineers in selecting measures that can be used to reduce bridge losses attributable to scour and bank erosion." As part of the study 282 case histories were documented. Countermeasures were assessed to reduce bridge losses.

Prepared for the Federal Highway Administration.

Category A&D-2.

BURSALI, S.

State Hydraulic Works, Ankara (Turkey), Department of Research.

"Economic Revetments for Protecting the Banks of Meric and Ergene Rivers Flood Canals Against Wave Erosion."

Flood levees constructed along the Meric and Ergene Rivers to protect agricultural lands against flood damage were observed and studied analytically in order to find out the main cause of damage on the water side slopes.

Proceedings of the International Association for Hydraulic Research Symposium on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973.

Category A&D-2.

COLSON, B. E. and WILSON, K. V.
Geological Survey, Jackson, MS.

"Hydraulic Performance of Bridges--Excavations at Bridges."

Excavation under bridges as a means of increasing their hydraulic capacity was studied by observing the stage and discharge through five bridge openings across a single flood plain.

Mississippi State Highway Department Report MSHD-RD-73-015-EB,
September 1973.

Category A&D-2.

ESTRUCO, J.

"Method of Protection for Slopes and Crests of Rivers, Channels, and the Like."

A method is disclosed for protecting slopes and crests of rivers, channels, and the like by mooring flexible and permeable tubular casing filled with fresh concrete.

Official Gazette of the United States Patent Office, Vol. 932, No. 3, p. 817, March 18, 1975.

Category A&D-2.

LARSEN, O. J. F.

"Device for Producing and Protecting Deposits of Sedimentary Material on the Floor of Bodies of Water."

A device is described for deposition and protecting sand and other littoral drift material on the floors of seas, lakes, rivers and other bodies of water where the bed and sides consist of erosionable material.

Official Gazette of the United States Patent Office, Vol. 927, No. 5, p. 1838, October 29, 1974.

Category A&D-2.

LINDNER, C. P. and FENWICK, G. B.
Committee on Channel Stabilization (Army).

"Chena River Lakes Project, Alaska, Problems Relating to Channel Development, Erosion, and Bank and Levee Protection."

This report is published by the Committee on Channel Stabilization primarily in furtherance of their objective, with respect to channel stabilization, to provide and advise on design and operational problems; and to review and evaluate pertinent information and disseminate results thereof.

U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, March 1973.

Category A&D-2.

NEW YORK STATE DEPARTMENT OF TRANSPORTATION, Albany.
Bureau of Soil Mechanics.

"Bank and Channel Protective Lining Design Procedures."

Procedures and guidelines are presented for the design of bank and channel protective linings.

Soils Design Procedure, SDP-2, August, 1971.

Category A&D-2.

PORTS, M. A.

Maryland Department of Natural Resources, Annapolis, Water
Resources Administration.

"Sediment and Erosion Control Design Criteria."

In an effort to control erosion and sediment caused by human activity, the Maryland legislature adopted, in 1970, a state-wide sediment control law.

The APWA Reporter, Vol. 42, No. 5, May 1975.

Category A&D-2.

A G G R A D A T I O N & D E G R A D A T I O N

PREDICTION/THEORETICAL
CATEGORY A&D-3

MILLER, M. C., MCCAVE, I.N. and KOMAR, P. D.
Oregon State University, Corvallis, School of Oceanography.

"Threshold of Sediment Motion Under Unidirectional Currents."

Carefully selected data for the threshold of sediment movement under unidirectional flow conditions were utilized to re-examine the various empirical curves that are commonly employed to predict the threshold.

Sedimentology, Vol. 24, No. 4, p. 507-427, August 1977.

Category A&D-3.

WHITE, W. R., MILLI, H., and CRABBE, A. D.
Hydraulics Research Station, Wallingford (England).

"Sediment Transport Theories: A Review."

Eight sediment transport theories were examined with reference to flume and field data. The comparison was based on over 1000 flume experiments. (quartz and lightweight materials) and 260 field measurements.

The Institute of Civil Engineers Proceedings, Part 2,
Research and Theory, Vol 59, p. 265-292, June 1975.

Category A&D-3.

A G G R A D A T I O N & D E G R A D A T I O N

MODELS (LAB & MATH)
CATEGORY A&D-4

AMAR, A. C. and THOMAS, W. A.
New South Wales Univ., Kensington (Australia). Faculty of
Military Studies.

"Digital Simulation of Aggradation and Degradation in Natural
Streams."

The analysis of scour and deposition by modeling the inter-
action between the water-sediment mixture, sediment material
forming the stream's boundary, and the hydraulic character-
istics of flow was presented using the Hydrologic Engineering
Center's computer program entitled 'Scour and Deposition in
Rivers and Reservoirs.' The results of the analysis were
useful for estimating the impact of aggradation on the design
profile for levees and the amount, frequency, and location
of maintenance dredging, as well as the effect of alternative
measures, for maintaining a channel.

Proceedings of the Third Federal Inter-Agency Sedimentation
Conference, 1976; Denver, CO., March 22-25, 1976. Water
Resources Council, Wash., D.C., Sedimentation Committee,
p. 4-26 - 4-36, 1976.

Category A&D-4.

ASADA, H. and ISHIKAWA, H.
Central Research Inst. of Electric Power Industry, Tokyo
(Japan), Technical Lab.

"River Bed Deformation Calculated by Practical Sediment
Discharge Formula."

The practical calculation methods of sediment discharge and
river bed deformation in the upper and middle reaches of
rivers are reviewed. Some of the sediment discharge formula
were examined through laboratory experiments in an attempt
to show the non-uniqueness of their solutions. A practical
sediment discharge formula is proposed on the basis of this
examination.

Hydraulic research and its impact on the environment; Pro-
ceedings of 14th Congress of International Assoc. for Hydrau-
lic Research, Paris, August 29-September 3, 1971, Vol. 3,
p. 57-64, 1972.

Category A&D-4.

PAGNOLD, R. A.
Rickwoods and Mark Beech, Edenbridge (England).

"Bed Load Transport by Natural Rivers."

Since stream power, ω , and sediment transport rate I are different values of the same physical quantity, namely, the time rate of energy supply and dissipation.

Water Resources Research, Vol. 13, No. 2, p. 303-312, April 1977.

Category A&D-4.

BRIDGE, J. S.
Queens University, Belfast (Northern Ireland), Department of Geology.

"Computer Simulation of Sedimentation in Meandering Streams."

A dynamic mathematical model for simulation of sedimentation in meandering streams was described.

Sedimentology, Vol. 22, No. 1, p. 3-43, February 1975.

Category A&D-4.

CHANG, FRED F. M.
South Dakota State University, Brookings.

"Computer Simulation of Riverbed Degradation and Aggradation by the Method of Characteristics."

For unsteady flow in alluvial channels, three characteristic equations can be derived from three basic equations. However, this introduces many computational difficulties, and only a graphic solution has been developed.

Proceedings 13th Congress of the International Assoc. for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol. 1 (Subject A), Science Council of Japan, Kyoto, p. 337-344, 1969.

Category A&D-4.

CHANG, H. H. and HILL, J. C.
San Diego State University, California Department of Civil Engineering.

"Computer Modeling of Erodible Flood Channels and Deltas."

The existing computer program for water-surface computation and delineation of the flood limit was extended to include the effect of channel deformation during a flood.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY10, Proceedings Paper 12485, p. 1461-1477, October 1976.

Category A&D-4.

CHANG, H. H. and HILL, J. C.
San Diego State University, California Department of Civil Engineering.

"Minimum Stream Power for Rivers and Deltas."

A numerical model for channel alterations was developed for sand bed rivers and deltas. The unsteady river flow was computed using the continuity equation and momentum equation of flow with prescribed boundary conditions.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 103, No. HY12, 1977.

Category A&D-4.

CHEN, Y. H. and SIMONS, D. B.
Colorado State University, Fort Collins, Department of Civil
Engineering.

"Mathematical Modeling of Alluvial Channels."

For study of the important aspects of the unsteady flow phenomena in alluvial channels, a mathematical model was utilized to represent the original hydraulic system.

Symposium on Modeling Techniques, Volume I, 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975.

Category A&D-4.

COMBS, P. G., THOMAS, W. A. and RUSSO, E. P.
Army Engineer District, Vicksburg, Miss.

"Application of Flow-Sediment Model to Red River."

A method of computing sediment transport throughout a reach of river was presented. More specifically, a method to determine areas of scour and deposition along the river and to identify tendencies of a rating curve to shift due to sediment movement was analyzed. The computer model was applied to the Red River.

Journal of the Hydraulics Div., ASCE, Vol. 103, No. HY1,
Proceedings Paper 12676, p. 11-18, January 1977.

Category A&D-4.

DE VRIES, M. and VAN DER ZWAARD, J. J.
Waterloopkundig Laboratorium, Delft (Netherlands).

"Movable-Bed River-Models."

For morphological problems in rivers both physical and mathematical models are used to forecast changes in the river bed due both to natural causes and human interference.

Symposium on Modeling Techniques, Volume I, 2nd Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE (2 Vol.), San Francisco, California, September 3-5, 1975.

Category A&D-4.

ENGELUND, F. and FREDSOE, J.

Technical University of Denmark, Copenhagen, Institute of
Hydrodynamics and Hydraulic Engineering.

"A Sediment Transport Model for Straight Alluvial Channels."

A simple mathematical model for sediment transport in straight alluvial channels is presented. The model, which is based on physical ideas related to those introduced by Bagnold, was originally developed in two steps, the first describing the bed load transport and the second accounting for the suspended load.

Nordic Hydrology, Vol. 7, No. 5, p. 293-306, 1976.

Category A&D-4.

FOLEY, M. G.

Calif. Inst. of Tech., Pasadena, Div. of Geological and Planetary Sciences.

"Scour and Fill in an Ephemeral Stream."

The classical concept that mean bed elevation over an entire stream reach is lowered by scour during flood-wave passage and is restored by deposition in the waning flood phase (mean-bed scour and fill) can be challenged. The alternative that both scour and fill occur simultaneously at different migrating LOCI within a reach (local scour and fill) is more consistent with published field data.

Proceedings of the Third Federal Inter-Agency Sedimentation Conference, 1976; Denver, CO., March 22-25, 1976. Water Resources Council, Wash., D.C., Sedimentation Committee, p. 5-1 - 5-12, 1976.

Category A&D-4.

FOLEY, M. G. and SHARP, R. P.
California Inst. of Tech., Pasadena.

"General Scour and Fill Along a Stream Reach."

A series of field and laboratory experiments showed that bed reworking by moderate floods in uniform reaches of steep, sand-bed ephemeral streams is predominantly by bedform development and migration, not by general scour and fill.

NTIS, Springfield, VA 22161 as AD-A-25 771, in paper copy, in microfiche. Final Report, June 7, 1976.

Category A&D-4.

FOLEY, M. G.
Missouri University-Columbia Department of Geology.

"Scour and Fill in Steep, Sand-Bed Ephemeral Streams."

A series of field and laboratory experiments is described in which total bed reworking during floods in sand bed ephemeral streams was compared with estimated or measured bed from amplitude.

Geological Society of American Bulletin, Vol. 89, No. 4,
p. 559-570, April 1978.

Category A&D-4.

GRAF, W. H. and PAZIS, G. C.
Ecole Polytechnique Federale de Lausanne (Switzerland),
Laboratoire D'Hydraulique.

"Deposition and Erosion in an Alluvial Channel (Les Phenomenes de Deposition et D'Erosion dans un Canal Alluvionnaire)."

Deposition and erosion of sediment particles were studied experimentally in a laboratory channel. It was found that for the same hydraulic conditions, deposition gives different numerical results than erosion.

Journal of Hydraulic Reserach, Vol. 15, No. 2, p. 151-166, 1977.

Category A&D-4.

IBAD-ZADE, J. A.

Vsesoyuznyi Nauchno-Issledovatel'skii Institut Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Baku (USSR).

"Modeling of Erodible Channels."

A series of problems such as bed formation, velocity distribution, load transport, and sedimentation were solved starting from the energy concept. The same concept was used as a basis of modeling of erodible channels.

Proceedings of the International Association for Hydraulic Research Symposium on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973.

Category A&D-4.

LEYTHAM, K. M.
Hydrocomp, Inc., Palo Alto, CA.

"The Simulation of Sediment Transport."

A deterministic, fixed bed stream sediment transport model has been developed which accepts inputs of water and sediment from the land surface phase as modeled by the Agricultural Runoff Management (ARM) model. A kinematic wave technique is used to simulate flows in the system. Interchange of suspended material with stream bed material, scour and aggradation, the effect of armoring on scour rates, and longitudinal dispersion due to variations in velocity are the major sediment processes represented.

Simulation Network Newsletter, (HYDROCOMP), Vol. 7, No. 8,
p. 1-8, November 15, 1975.

Category A&D-4.

MAHMOOD, K. and PONCE, V.M.
Colorado State University, Fort Collins, Engineering Research
Center.

"Computer Programs for Sediment Transport, Documentation and
Listing."

Five Fortran programs for the computation of sediment transport
were presented in the form of a reference manual with documen-
tation and listing included.

Available from the National Technical Information Service,
Springfield, Virginia 22161.

Category A&D-4.

MAHMOOD, K. and PONCE, V. M.
Colorado State Univ., Fort Collins, Engineering Research Ctr.

"Mathematical Modeling of Sedimentation Transients in Sand-Bed
Channels."

A mathematical model of sedimentation transients in ^Astraight
alluvial channels was presented. A coupled solution of the
momentum and sediment continuity equations enables the numer-
ical solution with longer time steps than are possible for un-
coupled models. Examples of various types of aggradation and
degradation problems that can be simulated by the model were
given.

NTIS, Springfield, VA 22161 as PB-252 274, in paper copy, in
microfiche. Research Report No. CER75-76KM-VMP28, April 1976.

Category A&D-4.

MILORADOV, M. and MUSKATIROVIC, D.
Institut Za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).

"Calculation of River Bed Deformation in Unsteady Flow."

A mathematical model is presented for calculation of defor-
mation of an alluvial river bed with complex cross-section
with developed meanders, under conditions of unsteady flow,
using an electronic digital computer. By using this procedure,
it is possible to calculate changes of the channel geometry.

Hydraulic research and its impact on the environment; Pro-
ceedings of 14th Congress of International Assoc. for Hydrau-
lic Research, Paris, August 29-September 3, 1971, Vol. 3,
p. 175-185, 1972.

Category A&D-4.

NIPPES, K. R.

Freiburg University, (West Germany), Geographisches Institut.

"New Method of Computation of the Suspended Sediment Load."

Until now it was difficult to compute the suspended sediment load. A new method was shown which needs only a small amount of measured data. A sufficiently precise computation of the suspended sediment load was possible by use of an area parameter.

Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 101, p. 659-666, 1974.

Category A&D-4.

SIMONS, D. B. and LI, R.M.
Colorado State University.

"Degradation Below the Emergency Spillway Chute of the Site 8C,
T or C Williamsburg Watershed, New Mexico."

The Soil Conservation Service proposed a flood retarding structure be built on the T or C Williamsburg watershed. A mathematical model based on the physical principles governing water and sediment transport was applied to the proposed geometry and flow conditions. Local and general scour values were predicted. Sediment is routed by sizes and armoring is incorporated in the model.

A report prepared for the U.S. Dept. of Agriculture, Soil Conservation Service, Albuquerque, New Mexico, 1977.

Category A&D-4.

SIMONS, D. B. And LI, R. M.
Colorado State University.

"Erosion and Sedimentation Analysis of San Juan Creek near Con-Rock Gravel Pit, Orange County, California."

An analysis of erosion and deposition in a reach of San Juan Creek and Bell Canyon associated with a gravel mining operation is presented. A mathematical model which routes water and sediment was applied to the river. Sediments routed by size. Four alternative solutions were tested in the model.

A report prepared for Dames & Moore, Denver, Colorado, 1978

Category A&D-4.

SIMONS, D. B. LAGASSE, PETER F. and LI, R.M.
Colorado State University, U.S. Military Academy (West Point),
Colorado State University.

"Plan of Study for Determining Hydraulics and Sediment Transport Characteristics of the Rio Grande River in New Mexico Above Elephant Butte Dam."

This report reviews mathematical models developed at CSU that route water and sediment as applied to various conditions. The models were used for soil plots, watersheds, channels and river systems. Physical processes were considered and the basic governing equations form a basis for the models.

Prepared for the U. S. Army Corps of Engineers, Albuquerque District.

Category A&D-4.

SIMONS, ROBERT K.
Colorado State University

"A Modified Kinematic Approximation for Water and Sediment Routing."

A second-order finite difference water routing model is developed and tested on various data. Either a kinematic or full dynamic expression for the momentum equation can be used. Sediment is routed by sizes and the concept of armoring is accounted for. Computed results agree well with observed data.

M. S. thesis, Colorado State University, 1977.

Category A&D-4.

SMITH, T. R.
University of Western Ontario, London, Department of Geography.

"A Derivation of the Hydraulic Geometry of Steady-State Channels from Conservation Principles and Sediment Transport Laws."

It is possible to build an analytical model of channel growth using necessary conditions for the existence of a river channel of finite width, namely, that sediment mass is conserved, that the channel form is sufficient to transport the water, the load of sediment, using reasonable approximations to laws of sediment transport.

Journal of Geology, Vol. 82, No. 1, p. 98-104, January 1974.

Category A&D-4.

THOMAS, W. A. and PRASHUHN, A. L.
Hydrologic Engineering Center, Davis, Calif.

"Mathematical Modeling of Scour and Deposition."

Movable stream bed profiles are being calculated in addition to water surface profiles. The initial gradation of sediment material in the stream bed may be prescribed to facilitate the calculation of an armor layer. The gradation is continually changed by the computer program in response to sediment particles being deposited on the stream bed and material on the stream bed being removed to satisfy transport capacity. Hydraulic sorting of sediment by grain size is accommodated.

Journal of the Hydraulic Div., ASCE, Vol. 103, No. HY8, Proceedings Paper 13132, p. 851-863, August 1977.

TSUCHIYA, AKIHIKO and ISHIZAKI, KATSUYUSHI
Public Works Research Institute, Tokyo (Japan).

"Estimation of River Bed Aggradation Due to a Dam."

A method for estimated river bed aggradation due to the construction of dams in torrential rivers is developed. The basic equation, which shows the degradation and aggradation of river beds, is developed from the condition of continuity and the discharge relation of bed load.

Proceedings 13th Congress of the International Assoc. for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol. 1 (Subject A), Science Council of Japan, Kyoto, p. 297-304, 1969.

Category A&D-4

U.S. Army/Hydrologic Engineering Center.

"Predictive Models of Movement and Control of Sediment in Rivers and Reservoirs."

The primary objective of this research is to consolidate the existing body of theory for sediment transport studies into a systematic method which utilizes the electronic computer to perform the calculations required for sediment studies. The results will be presented to field offices in the form of computer program manuals and etl's to ensure that field offices have a systematic approach for analyzing the sediment problems connected with their projects. Utilizing the existing digital computer programs, attention will be directed toward the development of a single, generalized program for the analysis of scour and deposition of sediments including the cohesive materials in a complex network of interconnected streams and tributaries.

U.S. Dept. of Defense/Army/Corps of Engineers, Fort Belvoir, VA 22060.

Category A&D-4.

U.S. Dept. of the Interior/Geological Survey/Water Resources Division.

"Transport Processes in Alluvial Channel."

Any modification of stream regimen results in a change pattern of erosion, transport, and deposition of sediment. This project is directed to developing methods for better predicting the transport of sediment by flowing water. To develop deterministic and stochastic models of sediment transport processes for use in modeling, predicting, and designing flow in alluvial channels. Special attention is given to stochastic models. Field data were collected to calibrate a one-dimensional finite-difference model of unsteady flow with coupled sediment transport. The model was developed by J.P. Bennett, Project No. 73-052.

U.S. Dept. of the Interior/Geological Survey/Water Resources Div., 12201 Sunrise Valley Dr., Reston, VA 22092.

Category A&D-4.

WITKOWSKA, H.
Technical University of Krakow (Poland).

"Mathematical Model of the River-Bed Erosion Below a Dam."

The principles of choosing a mathematical model of river-bed erosion were discussed. According to these principles mathematical models were proposed based on the gradually varied flow equation and on (1) Meyer-Peter, (2) Meyer-Peter-Muller, and (3) Gontcharoff Formulas for the bed load.

Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 101, p. 821-830, 1974.

Category A&D-4.

A G G R A D A T I O N & D E G R A D A T I O N

GENERAL
CATEGORY A&D-5

ACKERS, P., and WHITE, W. R.
Hydraulics Research Station, Wallingford (England).

"Sediment Transport: New Approach and Analysis."

The relationship of sediment transport to fluid flow was studied. Physical reasoning leads to dimensionless groupings of the variables, which are different for coarse sediment and for fine sediment because of dissimilar modes of transport. Analysis of experimental data supports the theory. Predictive equations related total sediment flux to measurable properties of flow.

→ ASCE Proceedings, Journal of the Hydraulics Division, Vol. 99, No. HY11, Paper 10167, p. 2041-2060, November 1973.4
Figure 2, Table 22.

Category A&D-5.

ADAMS, J., ZIMPFER, G. L., and MCLAND, C. F.
Victoria University, Wellington (New Zealand).

"Basin Dynamics, Channel Processes, and Placer Formation:
A Model Study."

The problems of the role of basin dynamics, tectonics, and channel processes in the formation of placers has not been well understood. These problems were investigated in a miniature drainage basin subjected to rejuvenation. Heavy mineral transport is controlled directly by channel activity. Storage occurs when the channel aggrades; and when the channel degrades, heavy minerals are concentrated in the channels and transported from the basin.

Economic Geology, Vol. 73, No. 3, p. 416-426, May 1978.

Category A&D-5.

ALVAREZ, J. A. MAZA and VILLANUEVA, C. C.
Universidad Nacional Autonoma de Mexico, Mexico City,
Department of Civil Engineering.

"Stable Channels in Alluvium."

In order to describe the three degrees of freedom of a stream in alluvium, three independent equations are needed to determine its stable shape.

Proceedings of the International Association for Hydraulic Research Symposium on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973.

Category A&D-5.

ASCE Task Committee for the Preparation of the Manual on Sedimentation of the Sediment Committee of the Hydraulics Division, Vito A. Vanoni, Editor.

"Sedimentation Engineering."

American Society of Civil Engineers Sedimentation Engineering is a general reference book on sedimentation. Topics discussed include hydraulic relations for alluvial streams, initiation of motion, sediment discharge formulas, sediment measurement techniques, sources and yields, control methods, economics of sedimentation and American sediment law.

Category A&D-5.

American Society of Civil Engineers, Hydraulics Division.

"Erosion of Cohesive Sediments."

Described is the relationship of cohesive sediments to problems associated with agricultural land and channel improvements, design criteria, and laboratory and field research.

ASCE Proc., J. of Hydraul. Div., Vol. 94, No. HY4, Paper 6044, pp 1017-1049, July 1968.

BAGNOLD, R. A.

Rickwoods and Mark Beech, Edenbridge (England).

"Bed Load Transport by Natural Rivers."

If stream power, ω , and sediment transport rate are the following general empirical relation: $I_{sub B}/(\omega - \omega_{sub 0})$ is approximately equal to $((\omega - \omega_{sub 0})/\omega_{sub 0})$ to the $\frac{1}{2}$ power times (Y/D) to the minus $2/3$ power.

Water Resources Research, Vol. 13, No. 2, p. 303-312, April 1977.

Category A&D-5.

BLENCH, T., PETERSON, A. W. and COOPER, R. H.
Alberta University, Edmonton.

"Comprehensive Graphs of Regime Data."

A discussion was given describing a graphical presentation of stream regime data in which average-steady depth and slope have been achieved by the sediment moved by a flow.

Proceedings of the International Association for Hydraulic Research Symposium on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973.

Category A&D-5.

BLENCH, T.

Alberta University, Edmonton, Dept. of Civil Engineering.

"Mobile-Bed Fluviology."

Mobile-bed hydraulics is discussed in a textbook intended for use in graduate courses and by professional civil engineers, hydraulic engineers, hydrologists, and water managers. Sediment transport, erosion, and sedimentation are examined from the viewpoint of self-adjustment after a disturbance of equilibrium.

Edmonton, Canada, The University of Alberta Press, 1969. 168 p. 30, Fig. 24, Plate 178, Ref. 2, append.

Category A&D-5.

BOGARDI, JANOS
Technical University of Budapest.

"Sediment Transport in Alluvial Streams."

Sediment Transport in alluvial streams is a reference or text book containing a summary of a large amount of technical material on sediment transport. It covers the theory of sediment movement, bedload, suspended load, empirical relations, alluvial hydraulics, regime theory and interpretation of sediment observations.

Publishing House of the Hungarian Academy of Sciences.

Category A&D-5.

BOZINOVIC, M.
Institut Za Vodoprivredu Jaroslav Cernt, Belgrade (Yugoslavia).

"Effect of Flow Variation Downstream of a Power Plant on the Bedload Discharge of Alluvial Rivers."

Periodic waves caused by powerplant operation may under certain conditions provoke a considerable increase of the total daily bed load balance in relation to the corresponding balance in steady flow. If such waves occur during a longer time interval then they may considerably influence the total annual bed load balance.

Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Vol. 3, p. 283-290, 1972.

Category A&D-5.

BULL, W. B. and SCOTT, K. M.
Arizona Univ., Tucson, Dept. of Geosciences.

"Impact of Mining Gravel from Urban Stream Beds in the Southwestern United States."

Large amounts of sand and gravel are excavated from stream channels, which are a convenient source of high-quality aggregate. Such mining has a potential impact both on the stream system from which the gravel is taken and on engineering structures in the vicinity of the stream.

Geology, Vol. 2, No. 4, p. 171-174, April 1974.

Category A&D-5.

BULLER, A. T. and MCMANUS, J.
Dundee University, Hewport-on-Tay (Scotland), Tay Estuary
Research Center.

"Channel Stability in Relation to Buried Unconsolidated
Sediments."

The processes of natural stabilization of the Tay estuary
shipping channel were examined with critical erosion velocity
diagrams.

Proceedings of the International Association for Hydraulic
Reserach Symposium on River Mechanics (4 Vol.), Bangkok,
Thailand, January 9-12, 1973.

Category A&D-5.

Calif. Inst. of Technology/Graduate School/Geological & Planetary Science.

"General Scour and Fill Along a Stream Reach 11908-GS."

The phenomenon of scour and fill in a riverbed during flood will be investigated to determine quantitatively the processes involved and the hydrological and sediment supply conditions which determine its occurrence.

U.S. Dept. of Defense/Army, USA.

Category A&D-5.

Colorado State University/Agric. Experiment Station.

"Hydraulics of Water Resource Systems."

Develop improved erosion and sedimentation theories: including transport, degradation and aggradation phenomena. The concepts of turbulence, diffusion and probability will be included in the theory to improve our working knowledge; study in greater detail the mechanics of flow in both alluvial and rigid boundary channels to increase the efficiency of water distribution, delivery, and application; consider the effects of water resources development on the river and its tributary system.

Colorado State Government, Denver, CO.

Category A&D-5.

Corps of Engineers, Davis, California, Hydrologic Engineering Center.

"Sediment Transport in Rivers and Reservoirs."

A U.S. Army Corps of Engineers seminar was held to discuss sedimentation problems. Sediment problems encountered in water resource projects may be classified as either technical or institutional.

Thomas, W. A., Editor, Proceedings of a Seminar on Sediment Transport in Rivers and Reservoirs, Corps of Engineers Hydrologic Engineering Center, April 709, 1970.

Category A&D-5.

CULBERTSON, D. M., YOUNG, L. E., and BRICE, J. C.
U. S. Geological Survey

"Scour and Fill in Alluvial Channels with Particular Reference to Bridge Sites."

The current knowledge of the behavior of alluvial channels as it applies to bridge site design and the problem of predicting scour and fill at highway crossings are discussed in detail. Mathematical methods for calculating the scour caused by simple gradual constrictions or estimated maximum probable scour at abrupt constrictions at piers are presented.

U.S. Geological Survey Open-File Rep., 1967.

Category A&D-5.

DIACONU, C.
Institutul De Meteorologi Si Hidrologie, Bucharest (Rumania).

"Erosion Phenomena in Drainage Basins Reflected by Sediment Flow in Rivers (Phenomenes D'Erosion Des Bassins Versants Requetes Par Les Transports Solides Des Cours D'eau)."

The long-term mean values of the sediment discharges, their territorial distribution, the laws of their variation with altitudes, as well as the characteristics of sediment discharges conditioned by the water flow were defined as the main characteristic elements of the sediment flow in rivers which themselves show the state of erosion in a basin.

International Association of Hydrological Sciences Publication No. 113, p. 47-61, 1974.

Category A&D-5.

ENVIRONMENTAL PROTECTION AGENCY.
Boston, Massachusetts, Region I.

"Connecticut River Basin Program, Part III, Phase I, Water Quality Reconnaissance for the Connecticut River Supplemental Study."

Factors primarily responsible for water quality in the Connecticut River, including stream flow variations, and nutrient, sediment and silt loss, are determined.

Available from the National Technical Information Service, Springfield, Virginia 22161.

Category A&D-5.

GESSLER, JOHANNES
Colorado State University.

"Aggradation and Degradation."

Causes of aggradation and degradation are outlined and the basic theory of sediment transport is given. Detection of non-equilibrium conditions is discussed. Methods of calculating final equilibrium conditions are demonstrated.

CH 8, River Mechanics, Vol. I, Shen, H. W. ed.

Category A&D-5.

GRAF, WALTER H.
Lehigh University

"Hydraulics of Sediment Transport,"

Hydraulics of Sediment Transport summarizes material on sediment transport. The text discusses a short history of sediment transport, hydrodynamics of fluid-particle systems, scour criteria, bedload, suspended load, bedform mechanics and sediment transport in closed pipes.

McGraw-Hill Book Co.

Category A&D-5.

HADLEY, R. F. and SHOWN, L. M.
Geological Survey, Lakewood, Colorado, Water Resource Division.

"Relation of Erosion to Sediment Yield."

Sediment yield is dependent on the gross erosion in the drainage basin and the transport efficiency of the channel network. The estimated conveyance for the whole basin indicated that only a very small part of the eroded material is presently being transported through the system.

Proceedings of the 3rd Federal Inter-Agency sedimentation Conference, 1976, held at Denver, Colorado, March 22-25, 1976.

Category A&D-5.

HAYASHI, T.
Chuo University, Tokyo (Japan), Hydraulic Lab.

"On the Cause of Meandering of Rivers."

The cause of the initiation of meandering of rivers was analyzed as a problem of three-dimensional stability of the erodible bed.

Proceedings of the International Association for Hydraulic Research Symposium on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973.

Category A&D-5.

International Association for Hydraulic Research, Delft
(Netherlands).

"Sediment Transportation, Volume I."

River mechanics was discussed at a symposium held at Bangkok in 1973. The four broad topics discussed in Volume I were: (1) Sediment Yield and Deposition, (2) Sediment Control and Scour, (3) Sediment Transportation, and (4) River Bed Form.

Proceedings of the International Association for Hydraulic Research Symposium on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973. Asian Institute of Technology, Bangkok, Thailand, p. 849.

Category A&D-5.

KARAUSHEV, A. V., BOGALIUBOVA, I. V. and BOBROVITSKAYA, N. N.
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).

"Water Erosion and Sediment Discharge."

The principles of research into water erosion were considered, interrelationships between the processes of erosion from the slopes of drainage basins and sediment discharge from river basins were given, both on the basis of general theoretical principles as well as with regard to topography, man's activities, etc.

International Association of Hydrological Sciences Publication
No. 133, p. 73-77, 1974.

Category A&D-5.

KLINGEMAN, P. C.

Oregon State University, Corvallis Dept. of Civil
Engineering.

"Hydrologic Evaluations in Bridge Pier Scour Design."

Several hydrologic evaluations are important for the design of bridge piers to protect them against streambed scour:
(1) prediction of the local stage versus discharge relation:
(2) determination of appropriate design floods, the recurrence intervals, and their stages: (3) selection of suitable streambed reference elevations.

Journal of the Hydraulics Division, American Society of
Civil Engineers, Vol. 99, No. HY12, Paper 10224, p. 2175-
2184, December 1973.4.

Category A-5, D-5.

LEOPOLD, LUNA B, WOLMAN, M. GORDON and MILLER, JOHN P.
U. S. Geologic Survey, the Johns Hopkins University, late of
Harvard University

"Fluvial Processes in Geomorphology."

Fluvial Processes in Geomorphology discusses landform development caused by running water to the hydraulic engineer chapters 6, 7 and 11 deal with water and sediment in channels, channel form and process and channel changes with time including aggradation and degradation.

W. H. Freeman and Co., 1964.

Category A&D-5.

MADDOCK, T., JR.
Geological Survey, Tucson, Arizona.

"Hydraulic Relations for Sand-Bedded Streams."

A good forecast can be made of the change in stream behavior owing to changes in a number of variables, such as discharges of water and sediment, sediment size, and temperature, given a sand-bedded stream channel and some knowledge of bank resistance.

Sedimentation, Symposium to Honor Professor H. A. Einstein, June 17-19, 1971.

Category A&D-5.

MAHMOOD, K., and SIMONS, D. B.
Colorado State University, Fort Collins,
College of Engineering.

"Bed Material Transport in Sand Bed Channels."

A bed material load function was developed for equilibrium flows in sand bed channels. This function was based on an average velocity profile. For graded sand bed materials, the function can be used by dividing the cumulative size distribution curve into fractions of equal probability. The size gradation of the bed material load is, therefore, also obtained. The cumulative gradation curves of total load predicted by the function were very close to those observed in the laboratory.

Sediment Transportation, Volume 1, Proceedings of the International Association for Hydraulic Research Symposium on River Mechanics (4 vol.), Bangkok, Thailand, January 9-12, 1973. Asian Institute of Technology, Bangkok, Thailand, p. 513-524, 5 Fig, 8 Ref.

Category A&D-5.

MALCOLM, H. R., JR. and SMALLWOOD, C., JR.
North Carolina State University at Raleigh, Department of Civil Engineering.

"Sediment Prediction in the Eastern United States."

Sediment discharge equations were derived for wooded, rural, urban and severely exposed watersheds on the east coast. Modeling techniques to study some impacts of urbanization on streams and lakes were used.

Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers, Vol. 103, No. WR2.

Category A&D-5.

MANUSE, L. J. and COMMINGS, A. B.
Geological Survey, Reston, Virginia.

"Sediment Transport by Streams Draining into the Delaware Estuary."

The quality of sediment transported by streams draining into the Delaware estuary varies already according to geology, physiography and land use.

Available from GPO, Washington, D.C. 20402.

Category A&D-5.

MELAND, N. and NORRMAN, J. O.
Louisiana State University, Baton Rouge, Coastal Studies Institute.

"Transport Velocities of Individual Size Fractions in Heterogeneous Bed Load."

In order to evaluate the importance of differential transport velocities as a factor in sediment sorting by size and shape, transport velocities of individual size fractions in heterogeneous size mixtures of spherical glass beads and natural material were determined for different transport rates.

Geografiska Annaler, Vol. 51A, No. 3, p. 127-144, 1969.

Category A&D-5.

MILLER, M. C., MCCAVE, I. N. and KOMAR, P. D.
Oregon State University, Corvallis, School of Oceanography.

"Threshold of Sediment Motion Under Unidirectional Currents."

Carefully selected data for the threshold of sediment movement under unidirectional flow conditions were utilized to re-examine the various empirical curves that are commonly employed to predict the threshold.

Sedimentology, Vol. 24, No. 4, p. 507-427, August 1977.

Category A&D-5.

MIRTSKHOULAVA, T. E.
Gruzinskii Nauchno-Issledovatel'skii Institut Gidrotekhniki i
Melioratsii, Tiflis (USSR).

"Scour in River Basin and its Bed Mechanism, Forecast."

The amount of washout from watershed slopes as a result of soil water erosion can be determined by suggested equations relating the slope and length.

Proceedings of the International Association for Hydraulic Research Symposium on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973.

Category A&D-5.

NELSON, L. M.
Geological Survey, Tacoma, Washington.

"Sediment Transport by Streams in the Deschutes and Nisqually River Basins, Washington, November 1971-June 1973."

Fluvial-sediment transport was studied in the Deschutes and Nisqually River Basins, Washington.

Open-file Report, 1974.

Category A&D-5.

NORDIN, C. F. and SABOL, G. V.
Geological Survey, Fort Collins, Colorado

"Estimating Average Sediment Yields from Annual Streamflow and Sediment Records."

Where simultaneous streamflow and sediment discharge records are available, linear relations between annual streamflow and annual sediment loads can be developed.

Vol. 1 of Proceedings of the International Association for Hydraulic Research, International Symposium on River Mechanics, January 9-12, 1973, Bangkok, Thailand.

Category A&D-5.

OMAN, G. E.

Soil Conservation Service, Upper Darby, Pennsylvania.

"Criteria for Stable Earth Channel Design."

In determining stability of an earth channel against erosion, the Soil Conservation Service uses either the allowable velocity or the allowable tractive stress methods. Both are based on the principle of the threshold of particle movement.

Paper 72-763, 1972 Winter Meeting American Society of Agricultural Engineers, Chicago, Illinois, December 1972.

Category A&D-5.

PAINTAL, A. S.

West Virginia Institute of Technology, Montgomery, Department of Civil Engineering.

"Concept of Critical Shear Stress in Loose Boundary Open Channels."

The problem of defining critical flow condition associated with the initial instability of bed material particles was reviewed in relation to existing concepts.

Text in English and French, Journal of Hydraulic Research, Vol. 9, No. 1, p. 91-113, 1971.

Category A&D-5.

POSEY, C. J.

Connecticut University, Storrs., Department of Civil Engineering.

"Erosion-Proofing Drainage Channels."

A large portion of soil eroded from land is scoured from the beds and banks of natural channels that are dry much of the time.

Journal of Soil and Water Conservation, Vol. 28, No. 2, March-April, 1973.

Category A&D-5.

Proceedings of the Federal Inter-Agency Sedimentation Conference, Bur. of Reclam., Denver, CO., May 608, 1947.

This publication contained the 24 papers and discussions of the First Federal Inter-Agency Sedimentation Conference. The conference was a working conference in which representatives of federal agencies confronted with sedimentation problems could discuss the problems and the methods being used for problem investigations and solution.

NTIS, Springfield, VA 22161 as PB-245 379, in paper copy, in microfiche. Sed/Com-01. January 1948.

Category A&D-5.

"Report of the Chief of Engineers to the Secretary of the Army on a Study of Streambank Erosion in the United States."

Only one percent of the nation's streams have been subjected to prior study. Eight percent of total stream bank miles are currently experiencing erosion to some degree. A candid admission of data insufficiency and inaccuracy is included.

Report of House Commission on Public Works, 91st Congress, 1st Session (October 1969).

Category A&D-5.

RICHARDSON, E. V., SIMONS, D. B., KARAKI, S., MAHMOOD, K, and STEVENS, M. A.
Colo. State Univ., Fort Collins, Dept. of Civil Engineering.

"Highways in the River Environment--Hydraulic and Environmental Design Considerations (Training and Design Manual)."

Through a coordinated effort between the Federal Highway Administration and Colorado State University, a training course was developed (1) to provide training in the practical application of the concepts of open channel flow, fluvial geomorphology, and river mechanics to the planning, location, design, construction, maintenance and operation of highways; and (2) to enable the participants to apply these concepts to environmental problems associated with highway crossings and encroachments.

NTIS, Springfield, VA 22161 as PB-261 090, in paper copy, in microfiche. Report FHWA-NHI-76-N005, May 1975.

Category A&D-5.

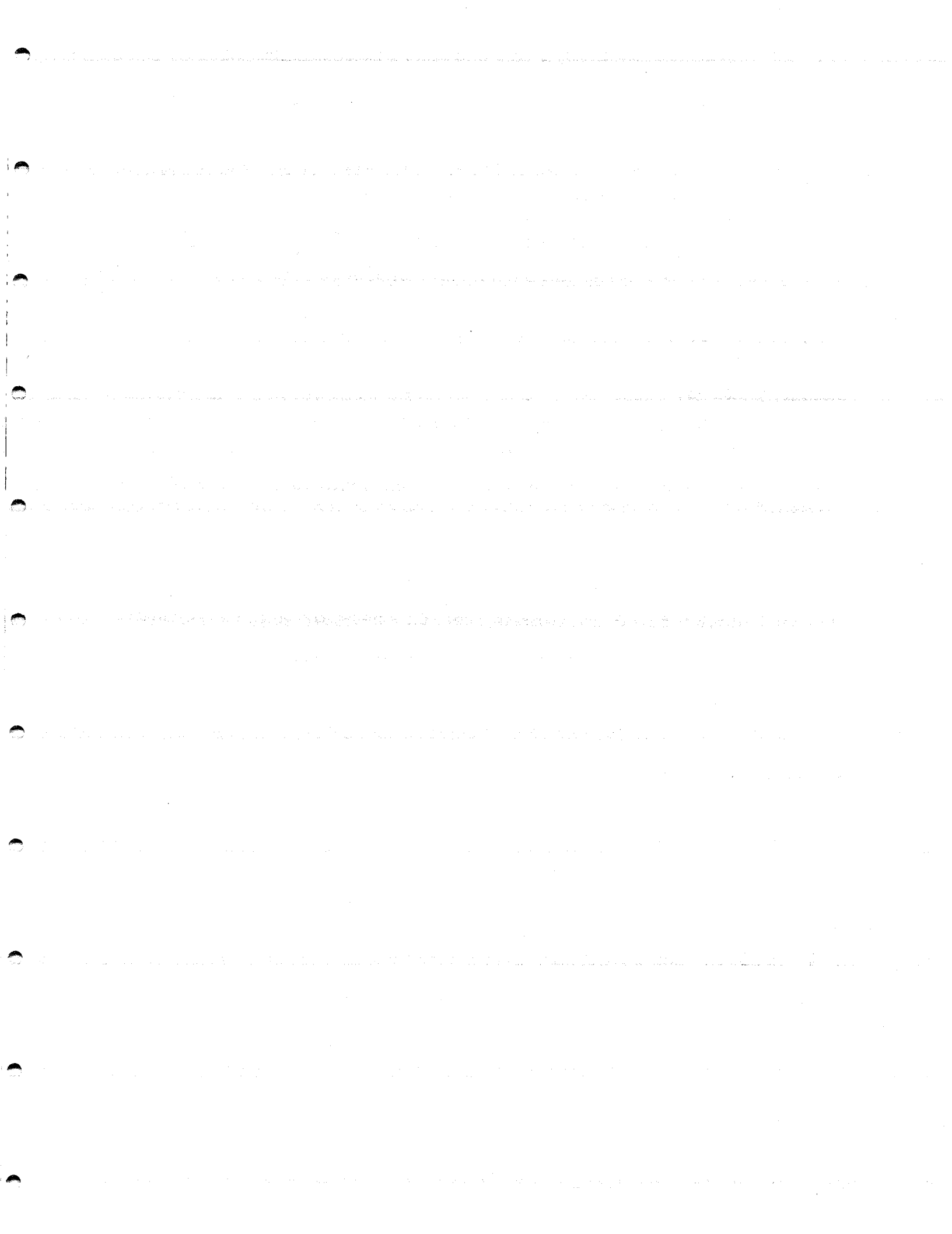
SARMA, S. V. K.
Regional Institution of Technology, Jamshedpur (India),
Department of Applied Mechanics.

"Stable Channels in Alluvial Material."

The principles of design of stable channels in coarse non-cohesive material were studied by the application of tractive force analysis.

Proceedings of the International Association for Hydraulic Research Symposium on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973.

Category A&D-5.



SCHUMM, S. A.
Colorado State University, Fort Collins, Department of Geology.

"River Metamorphosis."

Data collected from stable alluvial rivers on the great plains of western United States and on the riverine plain of south-easter Australia are used to demonstrate that channel width, depth, shape, meander wavelength, sinuosity and gradient are significantly related to the quantity of water and to the type of sediment load moving through these channels (ratio of bed-material load to total sediment load).

ASCE Proc., J. Hydraul. Div., Vol. 95, No. HY1, Paper 6352, pp. 255-273, January 1969.

Category A&D-5.

SCOTT, K. M.

"Effects of Permafrost on Stream Channel Behavior in Arctic Alaska."

Sites with drainage areas ranging from 88 to 12,200 km² were monitored on five streams in northern Alaska during the breakup in 1976 to determine (1) the effects of frozen bed and bank material on channel behavior, and (2) the importance of the annual breakup flood in forming the channels of arctic streams.

Geological Survey Professional Paper 1068, p. 17-19.

Category A&D-5.

SIMONS, D. B. and SENTURK, F.

Colorado State University, Dept. of Civil Engineering

"Sediment Transport Technology."

Sediment Transport Technology contains information on river morphology and response, basic hydraulics, properties of sediment, bed roughness, beginning of motion, design of stable channels, motion of bed material, degradation, aggradation and local scour. Basic equations are discussed on all topics and examples are provided.

Water Resources Publication, Ft. Collins, Colorado.

Category A&D-5.

SHULTIS, S. and HILL, R. D., JR.
Pennsylvania State University, University Park, Department of
Civil Engineering.

"Bedload Formulas, Part A. A Selection of Bedload Formulas.
Part B. Program Listings for Bedload Formulas."

Formulas for computing bedload are reviewed, and fortran program listings are given for digital computer solution of 14 of them.

Available from National Technical Information Service as PB-194 950.

Category A&D-5.

"Soil Erosion and Transport of Solids by Streams." (Erosion du Sol et Transports Solides des Cours D'eau).

Research in erosion by water, sedimentation in deltas and dams the mechanisms of transport (especially of bed-loads), the relations between fluid and solid discharge, radioisotopes, and other methodological studies are reviewed.

Status and Trends of Research in Hydrology, 1965-74.

Category A&D-5.

SURYANARAYANA, BHAMIDIPATY
Colorado State University

"Mechanics of Degradation and Aggradation in a Laboratory Flume."

Laboratory studies of aggradation and degradation were completed under steady flow with two experiments using uniform sand and one using graded sand. An equation describing the shape of the bed of a degrading channel which is concave downward. Aggrading beds are concave upward. Critical shear values agreed with Shields.

Ph.D. Dissertation, Colorado State University, 1969

Category A&D-5.

TIPPNER, M.

Bundesanstalt Fuer Gewaesserkunde, Coblenz (West Germany).

"On the Extent of Bottom Erosion in Large Rivers (Ueber Den Umfang Der Schlenerosion in Grossen Gewaessern)."

As a result of tributary regulation, large rivers such as the Rhine, Elbe, and Danube have been cut off, to a considerable extent from their original bedload supply sources.

Deutsche Gewaesserkundliche Mitteilungen, Vol. 17, No. 5, p. 125-130, October 1973.

Category A&D-5.

U. S. Dept. of the Interior/Geological Survey/Water Resources Division.

"Analysis of Sediment Erosion, Movement, and Deposition in and from Construction Areas in the Piedmont."

A better understanding of the sources, processes, and movement of sediment from construction areas into and through stream system is needed if effective erosion and sediment controls are to be used. The conventional universal soil loss equation, stream gaging, surveying, photogrammetry, sediment measurement, sediment analyses, and correlative techniques will be used where possible, and adjustments made as appropriate within the scope of available technology.

U.S. Dept. of the Interior/Geological Survey. Water Resources Div., 12201 Sunrise Valley Dr., Reston, VA 22092

Category A&D-5.

U.S. Dept. of the Interior/Geological Survey/Water Resources Div.

"Sediment Movement and Hillslope Morphology in the Central Appalachian Region."

Sediment, particularly in connection with major rainstorms and floods, causes many deaths and millions of dollars worth of damage annually. The destruction results from sediment erosion, its movement down hillsides and along stream channels and its deposition.

U.S. Dept. of the Interior/Geological Survey/Water Resources Div., 12201 Sunrise Valley Dr., Reston, VA 22092

Category A&D-5.

VOLKART, P., TSCHOOP, J. and BISAZ, E.
Eidgendessische Technische Hochschule, Zurich (Switzerland).

"The Effect of Sills on River Bed."

General statements were derived for the two-dimensional steady stress case on the basis of model tests. Size of the scouring basin between transverse sills in the natural river bed is defined.

Proceedings of the International Association for Hydraulic Research Symposium on River Mechnaics (4 Vol.), Bangkok, Thailand, January 9-12,1973.

Category A&D-5.

WATER RESOURCES COUNCIL.
Washington, D.C. Sedimentation Committee.

"Notes on Sedimentation Activities, Calendar Year 1974."

Information is presented which was furnished by Federal agencies conducting sedimentation investigations on (1) work in progress or planned, (2) important findings, on new methods, (3) new publications and (4) laboratory and other research activities.

Available from the National Technical Information Service,
Springfield, Virginia 22161.

Category A&D-5.

WATER RESOURCES COUNCIL.
Washington, D.C. Sedimentation Committee.

"Proceedings of the Third Federal Inter-Agency Sedimentation Conference 1976."

In the 13 years since the last conference, there has been a large amount of research and development work. The work group recommended that a third conference be held in March 1976.

Available from the National Technical Information Service,
Springfield, Virginia 22161.

Category A&D-5.

YANG, C. T., and STALL, J. B.
Illinois State Water Survey, Urbana.

"Unit Stream Power for Sediment Transport in Natural Waters."

The relationship between rate of sediment transport and rate of potential energy expenditure has been studied. Unit stream power, defined as the time rate of potential energy expenditure per unit weight of water, is shown to be the dominant factor in the determination of total sediment concentration. Basic concepts in fluid mechanics and boundary layer theory are used to establish the flow condition in incipient motion.

The National Technical Information Service, Springfield, Virginia 22161 as PB-235 415 \$3.75; in paper copy, \$2.25; in Microfiche - Illinois Water Resources Center, Urbana Research Report No. 88, July 1974.38, p. 32, Ref. 27.

Category A&D-5.

A G G R A D A T I O N

CASE HISTORIES
CATEGORY A-1

EMMETT, W. W.

Geological Survey, Boise, ID. Water Resources Division.

"Channel Aggradation in Western U.S. as Indicated by Observations at Vigil Network Sites."

In the semiarid and arid western United States channels at locations ranging from Montana to New Mexico are aggrading. This aggradation may signify a reversal of the widespread trend of arroyo cutting, which began about A.D. 1880.

Zeitschrift Fur Geomorphologie (Federal Republic of Germany), Vol. 21, p. 52-62, December 1974.

Category A-1.

HICKEY, JOHN J.
Geological Survey, Washington, D.C.

"Variations in Low-Water Streambed Elevations at Selected Stream-Gaging Stations in Northwestern California."

Graphs and a table are presented showing the variations in streambed elevations that have occurred over the years in the low-water channels at selected gaging stations in northwestern California. At 25 of 51 stations with data for that period, elevation changes exceeded 1 ft, and at 42 stations the changes represented fill, rather than scour.

Geology Survey Water-Supply Pap 1879-E, P E1-E33, 1969.

Category A-1.

JOHNS, E. L.

Bur. of Reclam., Boulder City, NV. Region 3; and Bur. of
Reclam., Boulder City, NV. RI.

"Sediment Problems in the Mohave Valley - A Case History."

Sedimentation technology plays an important role in the Bureau of Reclamation's lower Colorado River management program. Aggradation above Lake Havasu caused a critical situation near Needles, California, where railroad facilities and other developments were inundated or threatened by the rising river.

Proceedings of the Third Federal Inter-Agency Sedimentation Conference, 1976; Denver, CO., March 22-25, 1976. Water Resources Council, Wash., D.C., Sedimentation Committee, p. 4-64 - 4-75, 1976.

Category A-1.

KING, N. J.
U. S. Geological Survey.

"Appraisal of Watershed Management Program in Wind River Basin, Wyoming."

The Interior Department regional coordinator requested the Geological Survey to appraise the effectiveness of the watershed program in the wind river basin and to assess its value over the next 50 yr. The program was to reduce high sediment content of the streams and to prolong the life of Boysen reservoir.

U.S. Geological Survey Open-File Rep., 1968.

Category A-1.

A G G R A D A T I O N

CONTROL METHODS CATEGORY A-2

DOELHOMID, S.

Ministry of Public Works, Djakarta (Indonesia). Directorate General of Water Resources.

"Sediment Control and Remedial Works in the Brantas River, Java, Indonesia."

The behavior of the 320 KM long Brantas River in east Java is largely dominated by the inflow of volcanic debris from Mt. Kelud which has an eruption cycle of about 15 years. This debris is not all transported to the sea and in consequence there has been a gradual overall rise in river bed levels, which in the past century have been accelerated by man who has confined the river between flood embankments. The basic problem is flood prevention, and the solution lies in sediment control.

Sediment Transportation, Vol. 1; Proceedings of the International Assoc. for Hydraulic Research Symposium on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973. Asian Inst. of Technology, Bangkok, Thailand, p. 213-226.

Category A-2.

A G G R A D A T I O N

PREDICTION/THEORETICAL
CATEGORY A-3

MILHOUS, R. T. and KLINGEMAN, P.C.
Washington State Department of Ecology, Olympia.

"Sediment Transport System in a Gravel-Bottomed Stream."

The sediment transport system in a coarse-bedded mountain stream in the Oregon coast range has been studied for three years. The stream bed is nonhomogenous, with an armour layer of larger particles on top of finer material. It was found that there is an important interaction between the armour layer and the movement of material as bed load and as suspended load. The armour layer controls the sediment transport system by regulating the reservoir of sand and finer particles in the stream bed and by protecting the bed material from entrainment in the flow.

Proceedings of the 21st Annual Hydraulic Division Specialty Conference, Montana State University, Bozeman, Aug 15-17, 1973, ASCE, New York, p. 293-303, 1973.

Category A-3.

A G G R A D A T I O N

MODELS (LAB & MATH)
CATEGORY A-4

CHEE, S.P.

Windsor Univ. (Ontario), Dept. of Civil Engineering.

"Bed Slopes of Aggraded Channels With Two Degrees of Freedom."

An investigation of the bed slopes of aggraded channels with two degrees of freedom was conducted with the aid of hydraulic models. Sediment beds were formed in laboratory stream channels by supplying sediment from a calibrated upstream hopper while water was circulated by pumping.

Sediment Transportation, Vol. 1; Proceedings of the International Assoc. for Hydraulic Res. Sym. on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973. Asian Inst. of Tech., Bangkok, Thailand, p. 785-794.

Category A-4.

GARDE, R. J. and SWAMEE, P.K.
Roorkee Univ. (India), Dept. of Hydraulic Engineering.

"Analysis of Aggradation Upstream of a Dam."

The problem of predicting transient bed profiles upstream of a dam in an alluvial stream is important. The existing methods for numerical computation are time consuming and the stability of resulting solutions over a large number of cycles is not known. A new iterative method was described for predicting the deposition profile upstream of a dam.

Sediment Transportation, Vol. 1; Proceedings of the International Assoc. for Hydraulic Research Symposium on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973. Asian Inst. of Tech., Bangkok, Thail., p. 13-22.

Category A-4.

JENNINGS, M.E. and LAND, L. F.
Geological Survey, Bay St. Louis, MS, Water Resources Div.,
and Geological Survey, Miami, FL.

"Simulation Studies of Flow and Sediment Transport Using a
Mathematical Model, Atchafalaya River Basin, Louisiana."

Simulation studies were made of flow and sediment transport
for the Atchafalaya River Basin, Louisiana, using a mathemati-
cal model calibrated and supplied by the Hydrologic Engineering
Center and the New Orleans District, U.S. Army COE. The
analyses indicate a general trend of aggradation in the lower
part of the floodway with a consequent trend toward increasing
the inundated area, especially at higher flood flows.

NTIS, Springfield, VA 22161 as PB-268 707, in paper copy in
microfiche, Water-resources investigations 77-14, May 1977.

Category A-4.

PRASAD, S. N. and ALONSO, C. V.
Mississippi University, University Department of Civil
Engineering.

"Integral-Equation Analysis of Flows Over Eroding Beds."

The steady uniform flow in alluvial channel of rectangular cross section with a partially eroding bed is considered. The wetted perimeter is divided into an inner region in which the known critical tractive forces are exceeded, surrounded by a region where the fluid velocity is known to vanish.

Proceedings, ASCE Symposium on Inland Waterways for Navigation, Flood Control and Water Diversions, Aug. 10-12, 1976, Colo. State Univ., Fort Collins, CO, Vol. 1, p. 760-772.

Category A-4.

SONI, J. P., GERDE, R. J., and RAJU, K. G. RANGA.
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil
Engineering.

"Nonuniform Flow in Aggrading Channels."

The problem of resistance to flow and sediment transport rate
under nonuniform flow conditions obtained in aggrading channels
was investigated experimentally.

Journal of the Waterway, Port, Coastal and Ocean Div., ASCE,
Vol. 103, No. WW3, Proceedings Paper 13151, p. 321-333,
August 1977.

Category A-4

A G G R A D A T I O N

GENERAL
CATEGORY A-5

MADDOCK, THOMAS, JR.
Geological Survey, Tucson, Arizona.

"Behavior of Channels Upstream from Reservoirs."

Channel gradients above and below reservoirs, and even check dams have had little study. Recent statistical studies of gradients above check dams have been inconclusive. It is shown that the important factor yet unconsidered is the hydraulic relative roughness of the channel before and after the construction of the impeding structure. Since, for the same purely alluvial channel, roughness of an aggrading stream is less than that for a 'normal' stream, the gradients above dams are usually less than the natural gradient of a stream.

Hydrology of Lakes and Reservoirs, Symposium of Garda (Oct 9-15, 1966), International Assoc. of Scientific Hydrology, Publication No. 71, p. 812-823, 1966.

Category A-5.

D E G R A D A T I O N

CASE HISTORIES
CATEGORY D-1

EMMETT, W. W.
Geological Survey, Boise, Idaho.

"Channel Changes."

Environmental impacts may alter the quantities of water and sediment carried in a stream and thus may increase or diminish naturally occurring rates of channel changes and the pre-impact frequency of flows. One effect on stream channels from the impact of urbanization can be shown, by example from one stream, to be a loss in channel size due to deposition of sediment.

Geology, Vol. 2, No. 6, p. 271-272, June 1974.

Category D-1.

FURNESS, L. W., ALBERT, C. D., and LEONARD, R. B.
Geological Survey, Lawrence, Kansas.

"Kansas River, Bonner Springs to Mouth, Degradation of
Channel."

The stage of low discharges in the Kansas River between Bonner Springs and Turner Bridge degraded an average of 2.6 ft from 1952-1965. Degradation could be caused by increased regulation upstream, change in channel capacity, change in slope, change in sediment load, or removal of sand. Investigation of these factors showed that only sand removal is significant. The quantity of sand mined would have degraded the river 13.2 ft between 1939 and 1965 without upstream sediment supply, and actually resulted in 2.6 ft of net degradation.

Geological Survey Open-File Rep, Feb 1967.

Category D-1.

JOHNSON, M. V. and OMANG, R. J.
Geological Survey, Helena, Montana.

"Degradation of the Earthquake Lake Outflow Channel, Southwestern Montana."

The Madison River is cutting through the Madison slide, which was caused by the Hebgen Lake earthquake of August 17, 1959. Since July 15, 1960, the crest of the outlet channel of earthquake, on the slide, has been lowered about 4 feet by degradation. The outlet channel has been degraded as much as 19 feet in one short reach. Degradation of the channel was as much as 8.5 feet during the 1971 spring and summer runoff.

Geological Survey Research 1972, Chapter C/U S, Geological Survey Professional Paper 800-C, p. C253-C256, 1972.

Category D-1.

KLINGEMAN, P. C.
Oregon State Univ., Corvallis, Dept. of Civil Engineering.

"Indications of Streambed Degradation in the Willamette Valley."

A brief study of possible streambed elevation changes in the Willamette Basin was made to develop techniques for such analysis and to make a preliminary assessment of the extent of any indicated problems of streambed degradation and their likely causes. Streambed degradation along the main-stem Willamette is approximately 1 ft per decade and may be due to several factors, such as natural geological events, sand and gravel removal, bank stabilization, and watershed changes.

NTIS as PB-227 248 \$4.00 in paper copy, \$1.45 in microfiche.
Oregon State University, Corvallis, Water Resources Research Institute, Project Completion Report WRRI-21, December 1973.

Category D-1.

LAND, LYNTON S., and HOYT, JOHN H.
Lehigh Univ., Bethlehem, PA Marine Science Center; Georgia
Univ., Sapelo Island, GA., Marine Institute.

"Sedimentation in a Meandering Estuary."

Sand is being deposited in a meandering estuary separating
Sapelo and Blackbeard Islands, Georgia, in the channel of the
estuary and on two point bars associated with meanders.

Grant NSF G-16426. Study supported by Nat'l. Science Found.
Grant. Sedimentology, No. 6, pp. 191-207, 1966.

Category D-1.

PIEST, R. F., ELLIOTT, L. S., and SPOMER, R. G.
Agricultural Research Service, Columbia, MO.

Historic and geologic evidence indicated that channel and gully erosion was nearly nonexistent when the Loess-Mantled Tarkio Basin of Southwestern Iowa and Northwestern Missouri was settled about 1845. Some channel enlargement during the post-settlement period, 1845-1976, is quantified. Channel profile changes during recent years, 1939-1976, were reconstructed. The excessive scour in a channel reach of West Tarko Creek was explained tentatively on the basis of geomorphic principles and differences in substrata erodibility.

Transactions of the ASAE, Vol. 20, No. 3, p. 485-488,
May-June 1977.

Category D-1.

Soil Conservation Service, Washington, D.C.

"Sunrise Subwatershed, Little Sioux Flood Prevention Project, Iowa (Draft Environmental Impact Statement.)"

The proposed project involves the construction of three grade stabilization structures and one vertical inlet on an existing culvert in the sunrise subwatershed, in Woodbury County, Iowa. The project will remove the threat of gully erosion and land destruction to 127 acres of upland and will provide sediment reduction benefits to 330 acres of bottomland.

National Technical Information Service as PB-206 636D, \$3.00 in paper copy, \$0.95 in microfiche.

Category D-1.

Univ. of Kansas/Graduate School/Geology.

"Recent Gradational and Channel-Migration History of the Kansas River - A Guide for Floodplain Management."

Development of the Kansas City - Topeka Urban Corridor will be heavily influenced by behavior of the Kansas River as it periodically floods its valley floor and more or less continuously migrates across its floodplain. Control of or allowance for bank sloughing, channel migration, and apparent degradation must be based on an understanding of causes and trends

U.S. Dept. of the Interior/Office of Water Research & Tech.,
19th & C Sts., N.W., Wash., D.C. 20240.

Category D-1.

U.S. Dept. of the Interior/Geological Survey/Water Resources Div.

"Channel Adjustments Downstream from Cochiti Dam on the Rio Grande, New Mexico."

A possible additional 110,000 acre-feet of water will be added to the flow of the Rio Grande through the San Juan-Chama Transmountain Diversion. Cochiti Dam on the Rio Grande in New Mexico probably will start ponding water by 1972. Completion date for the dam is 1975 or later. Because this dam will trap virtually all of the sediment load originating upstream and discharge will be controlled, it is expected that equilibrium values of width, depth, slope, and sediment-transport capability in the existing main stem of the Rio Grande will change and that such changes will be reflected in scour in the channel.

U.S. Dept. of the Interior/Geological Survey/Water Resources Div., 12201 Sunrise Valley Dr., Reston, VA 22092.

Category D-1.

U.S. Dept. of the Interior/Geological Survey/Water Resources Div.

"Fluvial Morphology at Bridge Crossings - Tennessee."

The Tennessee Department of Transportation (TDOT) is experiencing severe problems with scour around piers and abutments at a number of existing bridges throughout the state. The TDOT has identified some 17 sites where known significant scour has occurred. In some instances, the scour has lead to bridge failures resulting in very significant costs for repair and/or replacement. The principal objectives of the study are to collect and analyze hydraulic and hydrologic information related to both local and general scour at bridge crossings, to set forth this information in a comprehensive manner for the use of design agencies, to enhance the competence of the TDOT and WRD in channel morphology, particularly in regard to the effects of channel modifications, and to develop techniques of data collection and analysis related to sediment transport problems.

U.S. Dept. of the Interior/Geological Survey/Water Resources Div., 12201 Sunrise Valley Dr., Reston, VA 22092.

Category D-1.

D E G R A D A T I O N

CONTROL METHODS
CATEGORY D-2

D E G R A D A T I O N

PREDICTION/THEORETICAL
CATEGORY D-3

AKSOY, S.

State Hydraulic Works, Ankara (Turkey).

"River-Bed Degradation Downstream of Dams."

The prediction of river-bed degradation downstream of large dams is a subject of increasing interest for engineers today. Because the mechanics of sediment movement by gradually varied unsteady flow is not known, present analyses are not yet capable of describing the degradation of bed. There are methods of empirical or semi-empirical nature.

Hydraulic Research and its Impact on the Environment: Proceedings of 14th Congress of International Assoc. for Hydraulic Research, Paris, August 29-September 3, 1971, Vol. 3, p. 275-282, 1972.

Category D-3.

ALVAREZ, J. A. MAZA and ALFARO, F. J. E.

Universidad Nacional Autonoma De Mexico, Mexico City, Dept. of Civil Engineering.

"Contribution to the Study of General Scour."

The general scour, which is the lowering that the river bottom undergoes when a flood occurs, is the primary cause of failure of numerous structures constructed in the river beds. The lowering of the river bottom by general scour is more important than the local erosion that endangers the existence of works such as piers, abutments, pipelines, etc. A method to evaluate general scour in river beds formed of sand or gravel was presented.

Sediment Transportation, Vol. 11; Proceedings of the International Assoc. for Hydraulic Res. Sym. on River Mechanics (4 Vol.), Bangkok, Thailand, January 9-12, 1973. Asian Inst. of Technology, Bangkok, Thailand, p. 795-803.

Category D-3.

ARTAMONOV, K. P., TALMAZA, V. P. and KROCHKINE, A. N.
Akademiya Nauk Kirgizskoi SSR, Frunze, Institut Vodnogo
Khozyaistva I Energetiki.

"On the Hydromorphometry of Alluvial Beds of Mountain Rivers
Composed of Heterogeneous Materials." (Questions D'hydro-
morphometrie Des Lits Alluviaux Des Cours D'Eau de Montagne
Formes de Materiaux Heterogenes).

In alluvial beds composed of heterogeneous material, it is
possible to define the mechanical structure of the sediments,
characteristic diameters, Karman's parameters, vertical velo-
city distribution, Chezy's coefficients, stable roughness,
width, average depth, scour velocity, stable longitudinal
inclination, and the maximum depth of the bed erosion.

Proceedings of 14th Congress of International Association for
Hydraulic Research, Paris, August 20-September 3, 1971.

Category D-3

HAMMAD, H. Y.

Alexandria University (Egypt), Faculty of Engineering.

"River Bed Degradation After Closure of Dams."

The release of clear water from dams built across rivers running in alluvial sediments will cause bed degradation in the downstream channel. If this degradation went unchecked, it would be a threat to the existing structures on the river, and might cause serious drainage problems in the cultivated areas on both sides of the river. A theory is presented to predict the ultimate conditions of bed armoring without sensible change in slope. The changes in bed roughness and in the regime of flow are both taken into consideration. The ultimate conditions of stable bed are obtained. The theory is then applied to the actual conditions of bed degradation of the Nile River after the closure of the Aswan High Dam in 1964.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 98, No. HY4, Paper 8814, P. 591-607, April 1972.

Category D-3.

KNOROZ, V. S.
Politekhnikheskii Institut, Leningrad (USSR).

"Natural Armoring and its Effect on Deformations of Channel Beds Formed by Materials Non-Uniform in Size."

The mechanism of natural sedimentary armoring is described. Formulae are given for calculating the depth of scour and the mean flow velocity at which armoring is completed.

Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Assoc. for Hydraulic Research, Paris, August 29-September 3, 1971, Vol 3, p. 35-42, 1972.

Category D-3.

KOMURA, S.
Gifu University (Japan), Department of Civil Engineering.

"River-Bed Variations at Long Constrictions."

Methods of predicting the equilibrium depth of scour for non-uniform bed material in long constrictions are presented. Relationships for the prediction of the equilibrium depth of scour are derived by applying dynamic and static equilibrium theories, and assuming that the bed configuration in an equilibrium state remains the same in both the constricted and unconstricted parts, but that the bed composition may be different. The armoring effect for nonuniform bed material is included in the prediction of the equilibrium depth of scour.

Hydraulic Research and its Impact on the Environment/Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29 - September 3, 1971, Vol 3, p. 109-116, 1972 (Release Date).

Category D-3.

MIRTSKHOULAVA, T. E. and MAGOMEDOVA, A. V.
Gruzinskii Nauchno-Issledovatel'skii Institut Gidrotekhniki i
Melioratsii, Tiflis (USSR).

"Prognosis of General Deformation of Natural and Artificial
Alluvial Beds Composed of Non-Uniform Material."

The coarsening resulting in natural pavement of the surface
layer of noncohesive material with scour is characterized by a
mean diameter of suspended particles, the value of which varies
in the process of scour.

Proceedings of 14th Congress of International Association for
Hydraulic Research, Paris, August 29-September 3, 1971.

Category D-3

D E G R A D A T I O N

MODELS (LAB & MATH)
CATEGORY D-4

ASHIDA, K. and MICHIE, M.
Kyoto University (Japan).

"An Investigation of River Bed Degradation Downstream of a Dam."

The results are given of an investigation concerning the degradation of a riverbed composed of graded material downstream of a dam. The investigation was based on the mechanics of bedload transportation for nonuniform sediment. The effect of nonuniformity of the material on the bedload transportation can be expressed by the difference of the threshold condition of movement for each grain size. Riverbed degradation can be treated by using a representative diameter for the sediment mixture when the material of every grain size is in the moving state. A method is proposed to predict the grain size frequency distribution of the armor coat and to estimate the amount of riverbed degradation based on an analytical model.

Proceedings, 14th Congress of the International Association for Hydraulics Research, Vol. 3, Paris, France, P. 247-255, Aug-Sept 1971.

Category D-4.

KOMURA, S.
Gifu Univ. (Japan), Dept. of Civil Engineering.

"Prediction of River-Bed Degradation Below Dams."

A differential equation for the rate of river-bed degradation is obtained from the equation of continuity for sediment transport and an equation of motion for sediment transport. The armoring effect for nonuniform bed material, which is an important factor in the analysis of degradation problems, is included in this analysis. By using the differential equation for degradation, methods were developed of predicting the river-bed degradation below dams in the transient phase.

Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Assoc. for Hydraulic Research, Paris, August 29-September 3, 1971, Vol 3, p. 257-264, 1972.

Category D-4.

PEMBERTON, E. L.

Bureau of Reclamation, Denver, Colo. Sedimentation Section.

"Einstein's Bedload Function Applied to Channel Design and Degradation."

Total bed material discharge, consisting of sand sizes or coarser material was studied in three river channels where total load sampling provided a check on the computations. The bedload function developed by Einstein required only limited adjustments to give an adequate comparison with the total transport for all sand sized fractions greater than .062 MM. In addition to channel design, the estimates of river degradation below a structure such as a dam requires an analysis of the transport by size fraction in order to assess the armoring effect in the degradation process. Three examples of channel design and degradation are presented to show how the adjusted Einstein bedload function is applied.

Sedimentation, Symposium to Honor Professor H. A. Einstein, June 17-19, 1971, Berkeley, CA/Hsieh Wen Shen, Editor, Colo. State University, p. 16-1 - 16-28.

Category D-4.

RZHANITZIN, N. A., RABKOVA, E. K., and ARTEMIEV, P. A.
Universitet Druzhby Narodov, Moscow (USSR).

"Deformation of Alluvial Channel Downstream from Large
Hydro-Projects."

Long-period investigations were made of a number of problems related to the influence of water flow control upon the channel downstream from a hydro-project. The data on the laboratory and field investigations of scour processes are given, and the typical patterns of deformations of the channel are derived. The reliability of computing methods is confirmed by actual data from existing hydro-projects.

Hydraulic Research and its Impact on the Environment: Proceedings of 14th Congress of International Assoc. for Hydraulic Research, Paris, August 29-September 3, 1971, Vol. 3, p. 265-274, 1972.

Category D-4.

ZNAMENSKAYA, N. S.
State Hydrological Institute, USSR.

"Computation of the Greatest Possible Depth of Channel
Degradation."

A method is proposed for computing maximum expected scour at proposed engineering works in channels with dune-form beds. To verify the proposed relationship, computations were made and compared with measured depth of scour on the Volga, Amu Darya, Syr-Darya, and Polomet' Rivers. In twenty-one comparisons, computations and measurements were within computed probability limits of depth of 10-1 percent.

Soviet Hydrol: Selec Pap, No. 2, pp 199-203, 1967. Translation from Meteorologiya i Gidrologiya, No. 4, pp 80-84, 1967.

Category D-4.

D E G R A D A T I O N

GENERAL CATEGORY D-5

EINSTEIN, HAN⁵A.

California University, Berkeley Department of Civil Engineering.

"Sediment Transport in Degrading Rivers."

When a dam is constructed across a river the equilibrium of sediment movement is greatly disturbed causing the river downstream to start degrading, a process that continues until a new equilibrium is reached. This report summarizes studies made on the subject since 1963.

California University Water Resources Center Technical Completion Report, January 22, 1969. 6 P., OWRR Project A-023-Cal(1).

Category D-5.

GARDE, R. J., ALI, K. A. -S/DIETTE, S.
Mosul University (Iraq), Department of Civil Engineering.

"Armoring Process in Degrading Streams."

Whenever the amount of sediment coming into a given reach of an alluvial stream is less than its sediment transport capacity, there is a general lowering of the stream bed-A process known as degradation. Thereafter, the coarsening process is extremely slow.

Journal of the Hydraulics Div., ASCE, Vol. 103, No. HY9,
1091-1095, September 1977.

Category D-5.

GESSLER, J.
Colorado State University, Fort Collins Department of Civil
Engineering.

"Critical Shear Stress for Sediment Mixtures."

The critical shear stress of material consisting of particles with a single grain size has been extensively investigated for many years. However, very little information is available on the behavior of sediment mixtures under various shear stresses. The critical shear stress of a sediment mixture is defined as the shear stress which will develop the coarsest armor coat, or the armor coat with the largest effective grain size.

Hydraulic Research and its Impact on the Environment/Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29 - September 3, 1971, Vol 2, p. 1-8, 1972.

Category D-5.

KLINGEMAN, P. C.

Oregon State Univ., Corvallis, Dept. of Civil Engineering.

"Hydrologic Evaluations in Bridge Pier Scour Design."

Several hydrologic evaluations are important for the design of bridge piers to protect them against streambed scour: (1) prediction of the local stage versus discharge relation; (2) determination of appropriate design floods, their recurrence intervals, and their stages; (3) selection of suitable streambed reference elevations; (4) assessment of hydrograph influences on channel stability with respect to channel alignment, streambed configuration, and streambed degradation; (5) evaluation of the effects of dams, dredging, and sand-and-gravel operations upon sediment transport near bridge piers; (6) evaluation of the effects of scour protection measures; and (7) anticipation of the magnitude of debris transport during floods as related to river stage and to watershed conditions. Method and difficulties in making these hydrologic evaluations are examined. The techniques considered rely mainly upon the development and analysis of stream-gaging records and the analysis of aerial photographs.

Journal of the Hydraulics Div., ASCE, Vol. 99, No. HY12, Paper 10224, p. 2175-2184, December 1973.

Category D-5.

MERCER, A. G. and COPPER, R. H.
Northwest Hydraulic Consultants Ltd., Vancouver; Northwest
Hydraulic Consultants Ltd., Edmonton.

"River Bed Scour Related to the Growth of a Major Ice Jam."

The bed scour caused by the formation and release of a major ice jam is a transient phenomena that is to some extent obliterated by the time that measurements of its scope can be safely made.

Proceedings of the Third National Hydrotechnical Conference,
Quebec, May 1977, p. 291.

Category D-5.

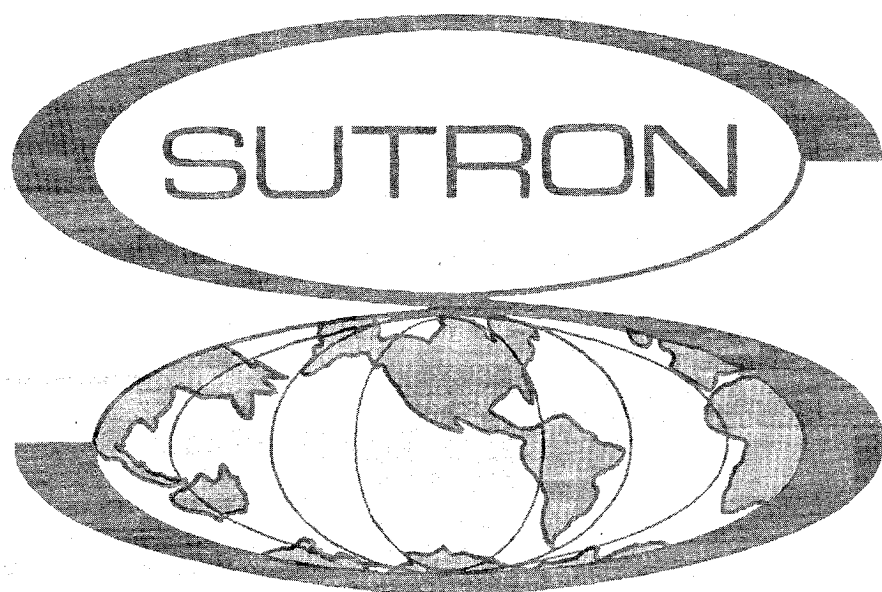
SHEN, H. W. and SURYANARAYANA, B.
Colorado State University, Fort Collins Department of Civil
Engineering.

"Variation of Roughness During Degradation."

The variation of roughness during a degradation study in a laboratory flume was found to be the same as that of the equilibrium flow. During degradation, the form resistance increased for sand finer than 0.6 MM and decreased for sand coarser than 0.6 MM. At the end of degradation, Shield's criterion for incipient motion was valid for sand coarser than 0.6 MM when the bed was plane and it was not valid for sand finer than 0.6 MM when the bed was rippled. (Woodward-USGS).

Proceedings 13th Congress of the International Association
for Hydraulic Research, Kyoto, Japan, August 31 - September 5,
1969, Vol. 5-1 (Seminars), Science Council of Japan, Kyoto,
p. 277-280, 1969.

Category D-5.





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